

REMARKS/ARGUMENTS

This is in response to the Office Action dated September 19, 2007. Claims 1-4, 6-19, 21-25, 27-31 are pending. Claims 1-21 stand rejected in the outstanding Office Action. Claims 22-28 have been objected to. Claims 1-4, 6-19, 21-25, 27-28 have been amended. Claims 5, 20 and 26 have been cancelled. New claims 29-31 have been added.

Applicant thanks the Examiner for the consideration of the Information Disclosure Statements filed on February 8, 2005, March 10, 2005 and March 24, 2005.

The Examiner's acknowledgment of the application's claim to foreign priority is appreciated.

The rejection of claim 18 as allegedly being indefinite under 35 U.S.C. § 112, second paragraph, is respectfully traversed. Claim 1 from which claim 18 depends has been amended so that it now refers to a tunable laser device, thus making claim 18 definite. It is respectfully submitted that the rejection of claim 18 be withdrawn.

The rejection of claims 1-4, 15, 18-21 as allegedly being anticipated under 35 U.S.C. § 102(e) by Ksendzov (US 6,856,641) is respectfully traversed. Ksendzov fails to disclose or even remotely suggest each and every limitation set forth in the claims. Anticipation requires that "each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference", *Verdegaal Bro. v. Union Oil Co. of California*, 814 F.2d 628, 631 (Fed. Cir. 1987) (MPEP § 2131).

Claim 1 has been amended to include the language of claim 5 (which has been cancelled).

Amended claim 1 now recites "A tunable ring laser comprising a ring laser comprising a ring resonator element and an optical gain element that that forms part or all of the ring resonator element". It is respectfully submitted that Ksendzov fails to disclose or suggest this limitation.

Ksendzov generally discloses a ring resonator laser (Fig. 7) wherein a ring resonator 700 is coupled to a straight input waveguide 1 that originates from a gain chip and to a straight output waveguide 2 connected to a Bragg grating. The Examiner acknowledged that the gain element does not form part or all of the ring resonator. With the newly amended claim 1, it is made clear that the optical gain element forms part or all of the ring resonator element of the tunable ring laser. It is respectfully submitted that the rejection of claim 1 based on Ksendzov be withdrawn.

The rejection of claim 5 (now incorporated into claim 1) under 35 U.S.C. § 103(a) as allegedly being obvious over Ksendzov (US 6,856,641) in view of Deacon (US 6,324,204) is respectfully traversed.

As explained above the Examiner acknowledged that Ksendzov does not disclose or suggest “A tunable ring laser comprising a ring laser comprising a ring resonator element and an optical gain element that that forms part or all of the ring resonator element”. The Examiner resorted to Deacon for the missing limitation.

Deacon generally describes a ring resonator structure (Fig. 9), wherein an amplifier chip 910 is coupled to waveguides 922 and 924. An optical grating 930 provides coupling between the optical modes of the two waveguides, allowing laser feedback to occur around the ring resonator formed by the two waveguides, coupler and amplifier chip. The Examiner argued that it would have been obvious to position the gain element as part of the ring resonator in Ksendzov’s device, as shown by Deacon, since doing so “will not modify the operation device because the optical gain element will provide the same function of amplification regardless of its position within the waveguides”.

It is respectfully submitted that neither Ksendzov, nor Deacon disclose the claimed configuration for the tunable ring laser, where the gain element is part of the ring resonator and the grating is not part of the fundamental laser resonator cavity.

The claimed tunable laser is characterized by the following two separate features:

Feature 1: The ring laser is formed by the ring resonator element and a gain element that forms part or all of the ring resonator element (as can be seen, for example, in Fig. 1A). The ring laser will operate independently as a laser without any extra elements.

This is in contrast to Ksendzov where the gain element is outside of the ring cavity (connected to the ring cavity through a waveguide). Ksendzov's gain element is therefore not part or all of a ring resonator element as claimed. This configuration, when without the grating element to reflect the light back, cannot provide the necessary resonance to independently operate as a laser. Therefore, even though the grating in Ksendzov's device is located outside of the ring cavity, it is an inseparable part of the laser resonator, without which the laser will not operate. Ksendzov's device can be seen as a DBR laser (consisting of a grating and a reflecting mirror on the far end of the gain element) with a ring filter in the middle.

Feature 2: The frequency selecting element (e.g., the reflective grating) is placed outside of the ring cavity and does not form part of the ring cavity.

This is in contrast to Deacon, where the grating is inseparable part of the ring cavity, as the grating performs the necessary coupling of the optical modes between the two separate waveguides forming the ring resonator. Therefore, in Deacon, the ring resonator cannot be formed without the grating, because without the grating to provide coupling of light the laser emission will cease.

Because of the inventive separation of the laser resonator and the tuning mechanism the main laser itself is not disturbed by the tuning action of the grating which is not part of the resonator. Once laser emission is established at the selected frequency in the ring resonator element, the grating is not necessary to sustain the emission and it plays no further part in deciding the frequency of the laser emission. This gives rise to a very rapid and stable tuning. This process is not obvious to one skilled in the art.

The above is not present in Ksendzonv and Deacon, since in both of the above references the tuning action inevitably disturbs the laser resonator because the grating is part of the resonator. In particular, both configurations are likely to be sensitive to the phase of the light reflected by the grating. The continued drift in grating reflection phase (as those skilled in the art are aware) is a key problem preventing rapid tuning and stabilization within a short period of time (e.g., 1 nanosecond or less) at a new frequency in many tunable laser configurations. For this reason, the position of the gain element relative to the ring resonator element does make a difference (unlike the Examiner's assertion) since the tuning process may affect the laser resonator operation.

Regarding amended independent claim 19 and new independent claims 29-31, it is made clear that the claimed method of selecting the lasing frequency of a ring laser includes "operating the optical gain element that forms part or all of the ring resonator element so that the ring laser emits a laser emission and operating the reflection frequency selection element located outside the ring resonator element and not forming part of the ring resonator element". For the reasons given above it is respectfully submitted that Ksendzov or Deacon fail to disclose the above limitations and the rejection of claims 19 and 29-31 should be withdrawn.

It is respectfully requested that the rejection of claims 2-4, 15, 18, 21-25, 27-28 which depend from claims 1 and 19, be also withdrawn.

In view of the foregoing and other considerations, all claims are deemed in condition for allowance. A formal indication of allowability is earnestly solicited.

The Commissioner is authorized to charge the undersigned's deposit account #14-1140 in whatever amount is necessary for entry of these papers and the continued pendency of the captioned application.

Should the Examiner feel that an interview with the undersigned would facilitate allowance of this application, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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